Part 3: GridWorld Classes and Interfaces

Set 3

Assume the following statements when answering the following questions.

Location loc1 = new Location(4, 3);

Location loc2 = new Location(3, 4);

1. How would you access the row value for loc1?

Answer: loc1.getRow()

2. What is the value of b after the following statement is executed?

boolean b = loc1.equals(loc2);

Answer: false

3. What is the value of loc3 after the following statement is executed?

Location loc3 = loc2.getAdjacentLocation(Location.SOUTH);

Answer: Location(4, 4)

4. What is the value of dir after the following statement is executed?

int dir = loc1.getDirectionToward(new Location(6, 5));

Answer: 135

5. How does the getAdjacentLocation method know which adjacent location to return?

Answer:

The parameter of getAdjacentLocation method gives a direction of the adjacent neighbor to find. The parameter of getAdjacentLocation method gives a direction of the adjacent neighbor to find.

Set 4

1. How can you obtain a count of the objects in a grid? How can you obtain a count of the empty locations in a bounded grid?

Answer: We use the method getOccupiedLocations to get a list of all object it the grid, and get the size of it, which is equal to the count of the empty locations. Then use the total locations substract the count of object. The code is as follows:

```
int occupiedCount = grid.getOccupiedLocations();
int totalCount = grid.getNumRows() * grid.getNumCols();
int emptyCount = totalCount – occupiedCount;
```

2. How can you check if location (10,10) is in a grid?

Answer: grid.isValid(new Location(10, 10));

If the location is not in the grid, the isValid method will return false, else return true.

3. Grid contains method declarations, but no code is supplied in the methods. Why? Where can you find the implementations of these methods?

Answer: Grid is an interface. In java, an interface declare the methods that the class need to implement. So, the implement of these method is in the class which implement the interface. Like AbstractGrid, BoundGrid and UnBoundGrid classes (AbstractGrid not implements all methods of Grid).

4. All methods that return multiple objects return them in an ArrayList. Do you think it would be a better design to return the objects in an array? Explain your answer.

Answer: ArrayList can grow dynamically. In the implements of these method, we don't know the count of objects of the grid. If we use an Array, we should first traversal the grid to get the number of objects of the grid. Which is inefficient. With an ArrayList, we can use add method to add elements to the list. So, use ArrayList will be better.

Set 5

1. Name three properties of every actor.

Answer: color, direction, location

2. When an actor is constructed, what is its direction and color?

Answer: An actor's initial direction is North and its initial color is blue.

3. Why do you think that the Actor class was created as a class instead of an interface?

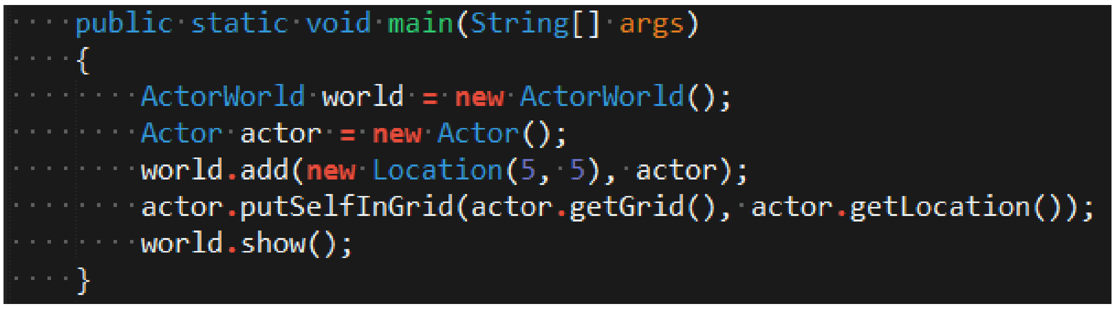
Answer: An actor has its own behavior like setColor and has its own state like its location. But an interface can't implements its method.

4. Can an actor put itself into a grid twice without first removing itself? Can an actor remove itself from a grid twice? Can an actor be placed into a grid, remove itself, and then put itself back? Try it out. What happens?

Answer:

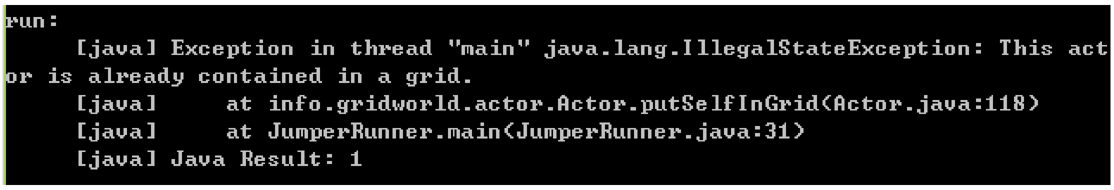
(1) No. If the actor is already in the grid, it may not put itself in the grid again.

The test code is as follows:



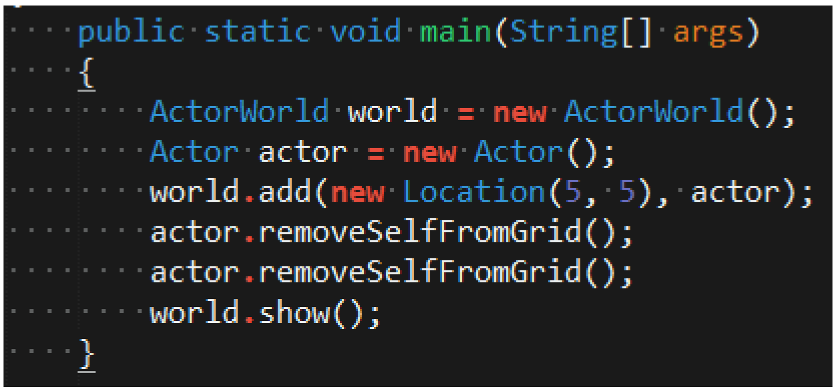
```
    public static void main(String[] args)
    {
        ActorWorld world = new ActorWorld();
        Actor actor = new Actor();
        world.add(new Location(5, 5), actor);
        actor.putSelfInGrid(actor.getGrid(), actor.getLocation());
        world.show();
    }
```

Run it, but an error occured.



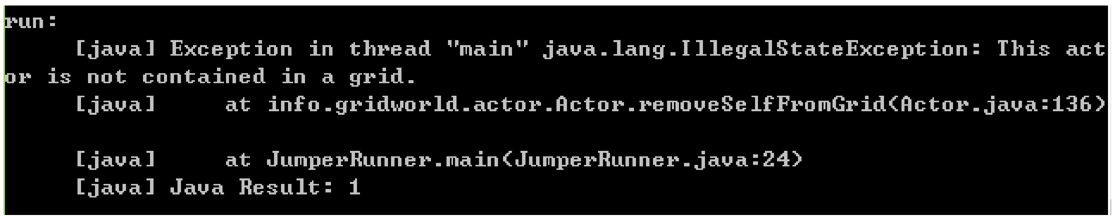
```
run:
     [java] Exception in thread "main" java.lang.IllegalStateException: This act
or is already contained in a grid.
     [java]     at info.gridworld.actor.Actor.putSelfInGrid(Actor.java:118)
     [java]     at JumperRunner.main(JumperRunner.java:31)
     [java] Java Result: 1
```

(2) No. The removeSelfFromGrid method removes the actor from its grid and makes the actor's grid and location both null. After remove, there isn't exist this actor anymore. The test code is as follows:



```java
    public static void main(String[] args)
    {
        ActorWorld world = new ActorWorld();
        Actor actor = new Actor();
        world.add(new Location(5, 5), actor);
        actor.removeSelfFromGrid();
        actor.removeSelfFromGrid();
        world.show();
    }
```

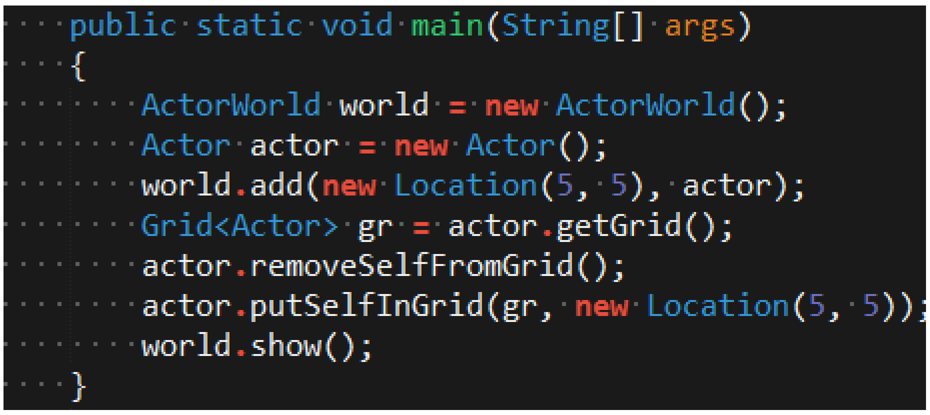
Run it, but an error occured.



```
run:
     [java] Exception in thread "main" java.lang.IllegalStateException: This act
or is not contained in a grid.
     [java]     at info.gridworld.actor.Actor.removeSelfFromGrid(Actor.java:136)

     [java]     at JumperRunner.main(JumperRunner.java:24)
     [java] Java Result: 1
```

(3) Yes. But we must remember the gird first.
The test code is as follows:



```java
    public static void main(String[] args)
    {
        ActorWorld world = new ActorWorld();
        Actor actor = new Actor();
        world.add(new Location(5, 5), actor);
        Grid<Actor> gr = actor.getGrid();
        actor.removeSelfFromGrid();
        actor.putSelfInGrid(gr, new Location(5, 5));
        world.show();
    }
```

5. How can an actor turn 90 degrees to the right?

Answer:

We can use the setDirection method. First get the original direction and add 90 degrees. Then set the direction of the actor with this angle. The code is as follows:

actor.setDirection(actor.getDirection() + Location.RIGHT);

or

actor.setDirection(actor.getDirection() + Location.EAST);

or

actor.setDirection(actor.getDirection() + 90);

Set 6

1. Which statement(s) in the canMove method ensures that a bug does not try to move out of its grid?

Answer:
```
if(!gr.isValid(next))
    return false;
```

2. Which statement(s) in the canMove method determines that a bug will not walk into a rock?

Answer:
```
Actor neighbor = gr.get(next);
return (neighbor == null) || (neighbor instanceof Flower);
```

3. Which methods of the Grid interface are invoked by the canMove method and why?

Answer: isValid and get. We can found the reason in exercise 1 and 2. We need isValid method to ensures a bug not try to move out of grid and get method to determines whether the next location is null or has a flower, if not, the bug can not move to.

4. Which method of the Location class is invoked by the canMove method and why?

Answer: getAdjacentLocation method. This method returns a valid location if the location in front of the bug is a valid location. Or return null. When bug need to know whether the next location can move to, it needs to get the information of the location in front of it.

5. Which methods inherited from the Actor class are invoked in the canMove method?

Answer: getGrid, getDirection and getLocation

6. What happens in the move method when the location immediately in front of the bug is out of the grid?

Answer: The bug will remove itself from grid.

7. Is the variable loc needed in the move method, or could it be avoided by calling getLocation() multiple times?

Answer: Yes. If the bug move successfully, move method will put a flower in its previous location. So move method need loc to store the previous location. The getLocation method can only get the current location of bug.

8. Why do you think the flowers that are dropped by a bug have the same color as the bug?

Answer: A flower will be put after the bug leave, when construting a flower, it will be set a color. Look this statement in the move method:

```
Flower flower = new Flower(getColor());
```

In this statement, getColor method will return the color of the bug, so we are sure that the flowers that are dropped by a bug have the same color as the bug.

9. When a bug removes itself from the grid, will it place a flower into its previous location?

Answer: No. When bug remove itself from grid, it call removeSelfFromGrid method. And the removeSelfFromGrid method is inherit from Actor. In removeSelfFromGrid, there is no code to put flower.

10. Which statement(s) in the move method places the flower into the grid at the bug's previous location?

Answer:

```
Flower flower = new Flower(getColor());
flower.putSelfInGrid(gr, loc);
```

11. If a bug needs to turn 180 degrees, how many times should it call the turn method?

Answer: 180 / 45 = 4 times.